Occupational health insights into environmental exposures

By Shannon Whirledge

The staggering number of chemicals registered for use in the U.S. — currently 80,000, with 2,000 new compounds introduced each year — suggests that human exposure risks may be largely underappreciated.

Manijeh Berenji, M.D., an occupational medicine specialist at Duke University, knows firsthand that exposures are common and can have a significant impact on health. She focused on the facts of environmental exposures in a Jan. 29 seminar titled "Environmental Exposures and Impact on Reproductive Health: Current Knowledge and Future Directions," hosted by Linda Birnbaum, Ph.D., director of NIEHS and the National Toxicology Program.

According to Berenji *(http://cfm.mc.duke.edu/modules/cfm_faculty/index.php?id=6)*, the American Chemical Society estimates that chemicals are currently used in approximately 96 percent of manufactured materials and products. From 1970 to 1995, the production of synthetic organic chemicals tripled, from 50 million to 150 million tons. This increase has contributed to an environment where numerous chemical compounds have not been vigorously tested for all types of toxicity, including reproductive toxicity.

Berenji's seminar allowed NIEHS researchers to see chemical exposures through a clinical lens. (Photo courtesy of steve McCaw)

Birnbaum suggested that Berenji's first-hand knowledge of the impact of chemical exposures would allow for rich collaborations with NIEHS researchers. (Photo courtesy of Steve McCaw)

Women in the workforce

In the last 40 years, the number of women in the workplace has more than doubled, from 30 million in 1970 to 67 million in 2007. Berenji noted that preconception and *in utero* exposures to toxic chemicals are associated with adverse outcomes at birth, including decreased fetal growth, preterm delivery, low birth weight, and birth defects. Furthermore, certain chemical exposures can lead to health consequences in offspring, as with dichlorodiphenyltrichloroethane (DDT). Although it is no longer used in this country, DDT may still be present in a significant portion of the population due to its persistence in the environment.

Understanding reproductive toxicity is a challenging task. According to Berenji, the gold standard for clinical research is the randomized control trial, in which study participants are randomly chosen to receive a certain treatment or exposure and are then compared to a control group. Because this is not an option when studying human chemical exposure, clinicians and scientists rely on animal models and epidemiological studies.

As an example, Berenji cited the Boston Birth Cohort *(http://www.jhsph.edu/departments/population-family-and-reproductive-health/center-on-early-life-origins-of-disease/projects.html)*, a study of an inner city, predominately African-American population that found levels of mercury in fetal cord blood 1.5 times higher than those found in maternal blood. Results indicated that *in utero* exposure to mercury may be underestimated, and the findings suggest that our understanding of chemical exposure risk is still developing.

Agricultural workers and pesticide use

According to Berenji, approximately 1.1 billion pounds of pesticides were used in the U.S. in 2006 and 2007, and agricultural workers experience especially persistent exposures. Of the 19,881 pesticide products registered in the U.S., more than 100 are listed as human neurotoxicants. Furthermore, pesticide exposure is linked to a greater risk of cancer, including breast, prostate, multiple myeloma, and leukemia.

During her residency at the University of California, San Francisco, Berenji taught agricultural workers in Salinas, California, about routes of exposure and measures they could take to minimize exposures. For example, she said, agricultural workers could reduce levels of exposure up to 80 percent simply by using chemically resistant gloves.

Berenji concluded by reviewing case studies that illustrated the need to determine routes of exposure — whether by skin, inhalation, ingestion, or mucous membrane — and to identify the proper medical specialists to involve. She emphasized the value of collaborations between clinicians and researchers, such as those at NIEHS, in developing a more complete understanding of consequences of chemical exposure.

From left, Thad Schug, Ph.D., of the NIEHS Population Health Branch; Joel Abramowitz, Ph.D., special assistant to the NIEHS Deputy Scientific Director, Jerry Heindel, Ph.D., also of the Population Health Branch; and Janet Hall, M.D., with Clinical Research Program, followed the seminar with interest and helped generate a thoughtful discussion. (Photo courtesy of Steve McCaw)

(Shannon Whirledge, Ph.D., is a Research Fellow in the NIEHS Laboratory of Signal Transduction.)

The Environmental Factor is produced monthly by the National Institute of Environmental Health Sciences (NIEHS) *(http://www.niehs.nih.gov/)*
, Office of Communications and Public Liaison.

This page URL: NIEHS website: http://www.niehs.nih.gov/
Email the Web Manager at webmanager@niehs.nih.gov